

# Chemical Engineering Science

List of Contents and Author Index  
Volume 48, 1993



**PERGAMON PRESS**

OXFORD · NEW YORK · SEOUL · TOKYO

# CHEMICAL ENGINEERING SCIENCE

---

## EDITORS

- PROF. J. BRIDGWATER (EXECUTIVE EDITOR) *Department of Chemical Engineering, University of Cambridge, Pembroke Street, Cambridge CB2 3RA, U.K.*
- PROF. J. BANDROWSKI *Silesian Technical University, Institute of Chemical Engineering and Apparatus Construction, Ul. Kuczewskiego 7, 44-101 Gliwice, Poland*
- PROF. A. T. BELL\* *Department of Chemical Engineering, University of California, Berkeley, CA 94720, U.S.A.*
- PROF. R. A. BROWN\* *Department of Chemical Engineering, Massachusetts Institute of Technology, Room 66-342, Cambridge, MA 02139, U.S.A.*
- PROF. J. F. DAVIDSON *Department of Chemical Engineering, University of Cambridge, Pembroke Street, Cambridge CB2 3RA, U.K.*
- PROF. G. FROMENT *Laboratorium voor Petrochemische Techniek, Rijksuniversiteit te Gent, Krijgslaan 271, 9000, Gent, Belgium*
- PROF. DR.-ING. E. D. GILLES *Institut für Systemdynamik und Regelungstechnik, Universität Stuttgart, D-70174 Stuttgart 80, Germany*
- PROF. M. KWAIK *Institute of Chemical Metallurgy, Beijing, China*
- PROF. E. N. LIGHTFOOT (BOOK REVIEW EDITOR) *Department of Chemical Engineering, University of Wisconsin, 1415 Johnson Drive, Madison, WI 53706, U.S.A.*
- DR R. A. MASHELKAR *National Chemical Laboratory, Pune 411008, India*
- PROF. D. M. RUTHVEN, *Department of Chemical Engineering, University of New Brunswick, PO Box 4400, Fredericton, NB, Canada E3B 5A3*
- DR P. TRAMBOUZE *Institut Français du Pétrole, Centre d'Etudes et de Développement Industriels, Boîte Postale 3, 69390 Vernaison, France*
- PROF. W. P. M. VAN SWAAIJ *Department of Chemical Engineering, Twente University of Technology, PO Box 217, 7500 AE Enschede, The Netherlands*
- PROF. J. VILLADSEN *Instituttet for Biotechnologi, Danmarks Tekniske Højskole, Bygning 223, 2800 Lyngby, Denmark*
- PROF. EMERITUS F. YOSHIDA *Department of Chemical Engineering, Kyoto University, Kyoto 606, Japan*
- \*See Notes for Contributors.
- 

Production Editor: PETER COLES

**Publishing, Advertising and Subscription Offices:** Pergamon Press Ltd, Headington Hill Hall, Oxford OX3 0BW, U.K., and Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

*Published semi-monthly*

*Annual institutional subscription rate (1993) £1012.00 (US\$1619.00)*

*Sterling price is definitive. US dollar price is quoted for convenience only, and is subject to exchange rate fluctuation*

*Personal subscription rate for those whose library subscribes at the regular rate is available on request*

*Subscription rates for Japan include despatch by air and prices are available on request*

*Prices include postage and insurance and are subject to change without notice*

*Subscription enquiries from customers in North America should be sent to: Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A., and for the remainder of the world to: Pergamon Press Ltd, Headington Hill Hall, Oxford OX3 0BW, U.K.*

Copyright © 1993 Pergamon Press Ltd

Second class postage paid at RAHWAY NJ and additional mailing offices. Postmaster send address corrections to *Chemical Engineering Science*, c/o Pergamon Press Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

©<sup>TM</sup>The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

Whilst every effort is made by the publishers and editorial board to see that no inaccurate or misleading data, opinion or statement appears in this journal, they wish to make it clear that the data and opinions appearing in the articles and advertisements herein are the sole responsibility of the contributor or advertiser concerned. Accordingly, the publishers, the editorial board and editors and their respective employees, officers and agents accept no responsibility or liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement.

## LIST OF CONTENTS

### Number 1

	iii	Danckwerts–Pergamon Prize
<b>P. L. Yue</b>	1	<b>Review Article Number 36. Modelling of kinetics and reactor for water purification by photo-oxidation</b>
<b>M. A. Northrup, T. J. Kulp, S. M. Angel and G. F. Pinder</b>	13	Direct measurement of interstitial velocity field variations in a porous medium using fluorescent-particle image velocimetry
<b>N. S. Kalospiros, G. Astarita and M. E. Paulaitis</b>	23	Coupled diffusion and morphological change in solid polymers
<b>R. Chirone, L. Massimilla and S. Russo</b>	41	Bubble-free fluidization of a cohesive powder in an acoustic field
<b>M. E. Hosseini-Ashrafi and U. Tüzün</b>	53	A tomographic study of voidage profiles in axially symmetric granular flows
<b>A. G. C. Ekvall</b>	69	Evolution of roll waves running down an inclined plane
<b>C. Dumouchel, M. I. G. Bloor, N. Dombrowski, D. B. Ingham and M. Ledoux</b>	81	Viscous flow in a swirl atomizer
<b>D. M. Ruthven and P. Stapleton</b>	89	Measurement of liquid phase counter-diffusion in zeolite crystals by the ZLC method
<b>M. Černá, V. Bízek, J. Št'astová and V. Rod</b>	99	Extraction of nitric acid with quarternary ammonium bases
<b>B. Kamphuis, A. W. Potma, W. Prins and W. P. M. van Swaaij</b>	105	The reductive decomposition of calcium sulphate—I. Kinetics of the apparent solid–solid reaction
<b>J. H. A. Kiel, W. Prins and W. P. M. van Swaaij</b>	117	Mass transfer between gas and particles in a gas–solid trickle flow reactor
<b>T. Miyahara and O. Kawate</b>	127	Hydrodynamics of a solid-suspended bubble column with a draught tube containing low-density particles
<b>S. Palanki, C. Kravaris and H. Y. Wang</b>	135	Synthesis of state feedback laws for end-point optimization in batch processes
<b>A. Schumpe</b>	153	The estimation of gas solubilities in salt solutions
<b>W. Meon, W. Rommel and E. Blass</b>	159	Plate separators for dispersed liquid–liquid systems: hydrodynamic coalescence model
<b>G. Daccord, R. Lenormand and O. Liétard</b>	169	Chemical dissolution of a porous medium by a reactive fluid—I. Model for the “wormholing” phenomenon
<b>G. Daccord, O. Liétard and R. Lenormand</b>	179	Chemical dissolution of a porous medium by a reactive fluid—II. Convection vs reaction, behavior diagram
<b>C. Yao and C. Tien</b>	187	Approximations of uptake rate of spherical adsorbent pellets and their application to batch adsorption calculations
	199	Corrigenda

**SYMPOSIUM IN PRINT: THE PREPARATION OF DISPERSIONS**

<b>H. N. Stein</b>	201	Editorial
<b>J. W. Vanderhoff</b>	203	Recent advances in the preparation of latexes
<b>W. Q. Zhao, B. Y. Pu and S. Hartland</b>	219	Measurement of drop size distribution in liquid/liquid dispersions by encapsulation
<b>F. Groeneweg, F. van Voorst Vader and W. G. M. Agterof</b>	229	The dynamic stability of W/O emulsions prepared from vegetable oil
<b>S. A. K. Jeelani and S. Hartland</b>	239	The continuous separation of liquid/liquid dispersions
<b>J. M. H. Janssen, G. W. M. Peters and H. E. H. Meijer</b>	255	An opposed jets device for studying the breakup of dispersed liquid drops
<b>P. H. M. Elemans, H. L. Bos, J. M. H. Janssen and H. E. H. Meijer</b>	267	Transient phenomena in dispersive mixing
<b>R. A. de Bruijn</b>	277	Tipstreaming of drops in simple shear flows
<b>W. J. Tjaberinga, A. Boon and A. K. Chesters</b>	285	Model experiments and numerical simulations on emulsification under turbulent conditions
<b>W. Gösele</b>	295	Precipitation to obtain easily separated solids
<b>Z. Sadowski</b>	305	The influence of the sodium oleate adsorption on the behavior of calcite suspensions
<b>S. G. Heijman and H. N. Stein</b>	313	Preparation of oxide dispersions which are stabilized both sterically and electrostatically
<b>H. Strauss, H. Heegn and I. Strienitz</b>	323	Effect of PAA adsorption on stability and rheology of TiO <sub>2</sub> dispersions
<b>P. Walstra</b>	333	Principles of emulsion formation
<b>P. J. M. Baets and H. N. Stein</b>	351	Drainage of CTAB films containing solid particles
<b>P. R. Garrett</b>	367	Recent developments in the understanding of foam generation and stability
<b>M. Kawaguchi and Y. Ryo</b>	393	Rheological properties of silica suspensions in aqueous cellulose derivative solutions
<b>V. N. Kislenco, Ad. A. Berlin and M. A. Moldovanov</b>	401	Suspension flocculation by partially hydrophobized polyacrylamide and kinetic model of flocculation
<b>P. A. Buining, C. Pathmamanoharan, A. P. Philipse and H. N. W. Lekkerkerker</b>	411	Preparation of (non-)aqueous dispersions of colloidal boehmite needles
<b>M. Leca</b>	419	Cataphoretically applicable film-forming disperse systems
<b>B. Vincent</b>	429	The preparation of colloidal particles having (post-grafted) terminally-attached polymer chains
<b>F. K. Hansen</b>	437	The function of surfactant micelles in latex particle nucleation

## Number 3

- P. Skovborg, H. J. Ng,  
P. Rasmussen and U. Mohn** 445 Measurement of induction times for the formation of methane and ethane gas hydrates
- M. V. Ramani, R. Kumar and  
K. S. Gandhi** 455 A model for static foam drainage
- G. Kraaijeveld and J. A. Wesselingh** 467 The kinetics of film-diffusion-limited ion exchange
- N. S. Tavaré and J. Garside** 475 Silica precipitation in a semi-batch crystallizer
- P. A. M. S. G. Mohamed and  
G. J. Jameson** 489 Hydrodynamics of a radial jet inductor
- A. O. E. Beyne and G. F. Froment** 503 A percolation approach for the modeling of deactivation of zeolite catalysts by coke formation: diffusional limitations and finite rate of coke growth
- F. Cuadros, A. Mulero and  
J. O. Valderrama** 513 Modification of the Soave equation of state suggested by using computer simulation
- R. C. Brown** 521 Correction of systematic errors in measuring convection coefficients in a liquid-fluidized bed
- T. L. Tolt and D. L. Feke** 527 Separation of dispersed phases from liquids in acoustically driven chambers
- M. Aurousseau, T. Hunger,  
A. Storck and F. Lapicque** 541 Electrochemical scrubbing of SO<sub>2</sub>-containing gas: coupling absorption to electrochemical reaction
- A. Chianese, F. Di Bernardino and  
A. G. Jones** 551 On the effect of secondary nucleation on the crystal size distribution from a seeded batch crystallizer
- J. Weiss** 561 Determination of the efficiency of an extraction unit by a response method
- S. S. E. H. Elnashaie and  
S. S. Elshishini** 567 Digital simulation of industrial fluid catalytic cracking units—IV. Dynamic behaviour
- P. G. Smirniotis and E. Ruckenstein** 585 The activity of composite catalysts: theory and experiments for spherical and cylindrical single pellets
- S. Y. Lee, J. D. Seader, C. H. Tsai  
and F. E. Massoth** 595 Multicomponent liquid-phase diffusion and adsorption in porous catalyst particles
- H. J. Keh and F. R. Yang** 609 Boundary effects of osmophoresis: motion of a vesicle normal to a plane wall
- M. Poletto, P. Salatino and  
L. Massimilla** 617 *Shorter Communications*  
Fluidization of solids with CO<sub>2</sub> at pressures and temperatures ranging from ambient to nearly critical conditions
- G. Carta** 622 The linear driving force approximation for cyclic mass transfer in spherical particles
- E. Rev and Z. Fonyo** 627 *Letter to the Editors*  
Comments on diverse pinch concept for heat exchanger network synthesis
- J. P. van der Eerden** 629 *Book Reviews*  
The Science of Crystallization. By W. A. Tiller
- P. G. Jones** 629 Dust Explosions in the Process Industries. By R. K. Eckhoff

- D. B. R. Kenning** 630 Liquid-Vapor Phase-change Phenomena. By Van P. Carey
- P. S. Hope** 631 Mixing in Polymer Processing. Edited by C. Rauwendaal

## Number 4

- L. Zhang and P. J. Fryer** 633 Models for the electrical heating of solid-liquid food mixtures
- J. S. Halow, G. E. Fasching,  
P. Nicoletti and J. L. Spenik** 643 Observations of a fluidized bed using capacitance imaging
- A. Fuchs, D. R. Lewin  
and S. J. Wajc** 661 Modelling, simulation and control of a crude oil preheating furnace
- F. G. Helfferich** 681 Multiple steady states in multicomponent countercurrent mass-transfer processes
- P. D. Frymier, R. M. Ford  
and P. T. Cummings** 687 Cellular dynamics simulations of bacterial chemotaxis
- A. N. S. Mak, P. C. Kuiper,  
P. J. Hamersma  
and J. M. H. Fortuin** 701 Continuous ion exchange in a pulsed packed column containing structured packing: mass-transfer-controlled kinetics
- L. M. Sun, F. Meunier  
and J. Kärger** 715 On the heat effect in measurements of sorption kinetics by the frequency response method
- R. Ivo and D. Pavel** 723 Pressure swing adsorption: analytical solution for optimum purge
- T. Salmi, E. Paatero  
and K. Fagerstolt** 735 Kinetic model for the synthesis of  $\alpha$ -chlorocarboxylic acids
- G. R. Schoofs and P. Petit** 753 Repressurization of adsorption purifiers for cryogenic air separation
- O. Molerus** 761 Arguments on heat transfer in gas fluidized beds
- A. C. Stewart, G. A. Davies  
and J. Garside** 771 The formation of particle clusters near an interfacial meniscus
- V. Hatzimanikatis, G. Lyberatos,  
S. Pavlou and S. A. Svoronos** 789 A method for pulsed periodic optimization of chemical reaction systems
- M. R. Hewgill, M. R. Mackley,  
A. B. Pandit and S. S. Pannu** 799 Enhancement of gas-liquid mass transfer using oscillatory flow in a baffled tube

*Shorter Communications*

- K. Schnitzlein** 811 Prediction of velocity profiles in packed beds
- A. Uribe-Salas, F. Vermet  
and J. A. Finch** 815 Apparatus and technique to measure settling velocity and holdup of solids in water slurries
- D. A. White and R. Canales** 819 A generalised algorithm for cascade mass balances

## Number 5

- G. Astarita and R. Ocone** 823 A perturbation analysis of the Aris puzzle
- E. A. Efthimiadis  
and S. V. Sotirchos** 829 Reactivity evolution during sulfidation of porous zinc oxide

- R. Krishna** 845 Problems and pitfalls in the use of the Fick formulation for intraparticle diffusion
- W.-M. Lu, K.-J. Hwang and S.-C. Ju** 863 Studies on the mechanism of cross-flow filtration
- V. Trentin, Ph. Brossard and D. Schweich** 873 Effects of composition on the equilibrium between hydrogen isotopes and palladium
- R. Di Felice** 881 Mixing in segregated, binary-solid liquid-fluidized beds
- W.-D. Deckwer and A. Schumpe** 889 Improved tools for bubble column reactor design and scale-up
- N. V. Shukla, P. B. Deshpande, V. Ravi Kumar and B. D. Kulkarni** 913 Enhancing the robustness of internal-model-based nonlinear pH controller
- R. S. MacTaggart, H. A. Nasr-El-Din and J. H. Masliyah** 921 Sample withdrawal from a slurry mixing tank
- P. M. Wilkinson, B. Doldersum, P. H. M. R. Cramers and L. L. van Dierendonck** 933 The kinetics of uncatalyzed sodium sulfite oxidation
- G. Amos, M. J. Rhodes and H. Mineo** 943 Gas mixing in gas-solids risers
- M. A. Ioannidis and I. Chatzis** 951 Network modelling of pore structure and transport properties of porous media
- C. L. Briens, M. Del Pozo, K. Chiu and G. Wild** 973 Modeling of particle-liquid heat and mass transfer in multiphase systems with the film-penetration model
- M. P. Harold and P. C. Watson** 981 Bimolecular exothermic reaction with vaporization in the half-wetted slab catalyst
- Letters to the Editors*
- M. J. Hounslow** 1005 Comments on analysis of a continuous crystallizer with agglomeration
- R. Y.-M. Lui and R. W. Thompson** 1006 Authors' reply to comments by M. J. Hounslow
- S. P. Waldram, U. Ullah, C. J. Bennett and T. Truex** 1007 Comment on monolithic reactors: mass transfer measurements under reacting conditions
- Book Reviews*
- A. Fredenslund** 1009 Theory of Macroscopic Systems. By C. Ouwkerk
- M. J. Rhodes** 1009 Fluidization Engineering. By D. Kunii and O. Levenspiel
- L. J. Ford** 1010 Handbook of Imaging Materials. Edited by A. S. Diamond
- 1011 Corrigendum

## Number 6

- G. Kuncová, J. Zahradník and J. Mach** 1013 Light transmission probe connected with spectrophotometer HP-8452 for local measurements in bubble columns

- |   |      |  |
|---|------|--|
| <b>M. N. Bogere and M. S. Willis</b>                                      | 1019 | Analysis of diffusion/dispersion and mass transfer phenomena in multiphase-multicomponent systems: application to heterogeneous processes with interfacial effects |
| <b>J. H. Han and S. D. Kim</b>  | 1033 | Bubble chord length distribution in three-phase fluidized beds   |
| <b>A. K. Das and B. W. Wojciechowski</b>                                  | 1041 | A one-parameter model of catalyst deactivation for FCC modelling   |
| <b>A. M. Simon and Z. J. Grzywna</b>                                      | 1051 | Time-lag analysis of mass transport through catalytically active membranes   |
| <b>K. W. Marosek, J. R. E. Christy, N. Macleod and S. Williamson</b>      | 1061 | Development of a concurrent liquid-liquid core-annular flow column to prevent wall deposition in coagulation studies   |
| <b>R. N. Paunović, Z. Z. Zavargo and M. N. Tekic</b>                      | 1069 | Analysis of a model of hollow-fiber bioreactor wastewater treatment  |
| <b>A. G. Gayubo, J. M. Arandes, A. T. Aguayo, M. Olazar and J. Bilbao</b> | 1077 | Calculation of the kinetics of deactivation by coke in an integral reactor for a triangular scheme reaction  |
| <b>J. Reisener, M. A. Reuter and J. Krüger</b>                            | 1089 | Modelling of the mass transfer in gas-sparged electrolysers with neural nets   |
| <b>R. G. Jordi and D. D. Do</b>   | 1103 | Analysis of the frequency response method for sorption kinetics in bidispersed structured sorbents   |
| <b>A. Lyngfelt and B. Leckner</b>   | 1131 | Model of sulphur capture in fluidised-bed boilers under conditions changing between oxidising and reducing   |
| <b>T. Dyakowski and R. A. Williams</b>                                    | 1143 | Modelling turbulent flow within a small-diameter hydrocyclone  |
| <b>C. D. Leigh and D. M. Smith</b>  | 1153 | A piecewise-linear approximation to diffusion with nonlinear interactions: nonlinear sorption  |
| <b>V. Hejtmánek and P. Schneider</b>                                      | 1163 | Axial dispersion under liquid-chromatography conditions  |
| <i>Shorter Communications</i>   |      |  |
| <b>E. S. Kikkinides and R. T. Yang</b>                                    | 1169 | Further work on approximations for intraparticle diffusion rates in cyclic adsorption and desorption   |
| <b>A. G. Livingston and J. B. Noble</b>                                   | 1174 | Mass transfer in liquid-solid fluidized beds of ion exchange resins at low Reynolds numbers  |
| <i>Letters to the Editors</i>   |      |  |
| <b>E. Alper</b>   | 1179 | Comments on kinetics of reaction of carbonyl sulphide with aqueous MDEA  |
| <b>R. J. Littel</b>   | 1180 | Author's reply to comments by E. Alper   |
| <i>Book Reviews</i>   |      |  |
| <b>P. Gawthrop</b>  | 1181 | Artificial Intelligence in Chemical Engineering. By T. E. Quantrille and Y. A. Liu   |
| <b>H. Hofmann</b>   | 1181 | Dechema Chemistry Data Series, Vol. 14. By W. Hao, H. S. Ebro and P. Alessi  |
| <b>J. R. Blake</b>  | 1182 | Interfacial Transport Phenomena. By J. C. Slattery   |
| <b>R. Mann</b>  | 1182 | Diffusion in Zeolites and Other Microporous Solids. By J. Käger and D. M. Ruthven  |



- C. G. J. Baker 1183 Advances in Drying—Vol. 5. Edited by A. S. Mujumdar
- Number 7
- S. Le Roy, A. Barreau and J. Vidal 1185 Vapor-liquid equilibria calculations with a cubic equation of state: group contributions for heavy hydrocarbons containing mixtures
- E. A. Efthimiadis and S. V. Sotirchos 1201 A partially overlapping grain model for gas-solid reactions
- P. M. Wilkinson, A. van Schayk, J. P. M. Spronken and L. L. van Dierendonck 1213 The influence of gas density and liquid properties on bubble breakup
- B. Remiarová, A. Brunovská and M. Morbidelli 1227 Sulphur poisoning of nonuniformly impregnated Pt-alumina catalysts
- S. S. Pandit, V. A. Juvekar and M. K. Trivedi 1237 Stochastic simulation of polymer reactions
- Y.-M. Chen and L. T. Fan 1251 Synthesis of complex separation schemes with stream splitting
- L. Hailu and J. F. Davidson 1265 Measurement of the distribution of fines in a batch fluidised bed by a direct sampling technique
- R. J. Wijngaarden and K. R. Westerterp 1273 A heterogeneous model for heat transfer in packed beds
- M. A. Reuter, J. S. J. van Deventer and T. J. van der Walt 1281 A generalized neural-net kinetic rate equation
- C.-Y. Shiau and C.-J. Lin 1299 An improved bubble assemblage model for fluidized-bed catalytic reactors
- G. M. Zhong and F. Meunier 1309 Linear perturbation chromatography theory: moment solution for two-component nonequilibrium adsorption
- X. Hu and D. D. Do 1317 Multicomponent adsorption kinetics of hydrocarbons onto activated carbon: contribution of micropore resistance
- P. F. B. Hansen, K. Dam-Johansen and K. Østergaard 1325 High-temperature reaction between sulphur dioxide and limestone—V. The effect of periodically changing oxidizing and reducing conditions
- C. B. Ching, K. H. Chu, K. Hidajat and D. M. Ruthven 1343 Experimental study of a simulated counter-current adsorption system—VII. Effects of non-linear and interacting isotherms
- Shorter Communication*
- S. Kagueli and N. Wakao 1353 Diffusion of adsorbate through slab adsorbents: investigation of diffusion modes
- Book Reviews*
- J. M. Woodley 1357 Extractive Bioconversions. Edited by B. Mattiasson and O. Holst
- E. T. Woodburn 1357 Flotation: Theory, Reagents and Ore Testing. By R. D. Crozier
- P. Meares 1358 Polymers for Gas Separation. Edited by N. Toshima

## Number 8

## v Seventh P. V. Danckwerts Memorial Lecture

- |   |      |   |
|---|------|---|
| <b>H. L. Beckers</b>  | 1359 | Seventh P. V. Danckwerts Memorial Lecture presented at Glaziers' Hall, London, U.K., 12 May 1992: Industrial R&D and competition        |
| <b>V. Julka and M. F. Doherty</b>                                 | 1367 | Geometric nonlinear analysis of multicomponent nonideal distillation: a simple computer-aided design procedure                          |
| <b>R. de Goede and E. J. de Jong</b>                              | 1393 | Heat transfer properties of a scraped-surface heat exchanger in the turbulent flow regime   |
| <b>M. K. Popović and C. W. Robinson</b>                           | 1405 | Mixing characteristics of external-loop airlifts: non-Newtonian systems   |
| <b>E. L. Cheluget, M. E. Weber and J. H. Vera</b>                 | 1415 | Modifications of the Flory-Huggins-Goldstein model for accurate description of closed-loop phase diagrams                               |
| <b>T. D. Karapantsios, N. A. Tsochatzidis and A. J. Karabelas</b> | 1427 | Liquid distribution in horizontal axially rotated packed beds   |
| <b>S. Y. Lee, C. J. Coronella, J. D. Seader and C. H. Pitt</b>    | 1437 | Erosion-corrosion of 316 stainless steel rods immersed in a bubbling fluidized bed  |
| <b>V. Bizek, J. Horáček and M. Koušová</b>                        | 1447 | Amine extraction of citric acid: effect of diluent  |
| <b>H. B. R. Ackeskog, A. E. Almstedt and V. Zakkay</b>            | 1459 | An investigation of fluidized-bed scaling: heat transfer measurements in a pressurized fluidized-bed combustor and a cold model bed     |
| <b>Z. H. Rojkowski</b>  | 1475 | Crystal growth rate models and similarity of population balances for size-dependent growth rate and for constant growth rate dispersion |
| <b>S. V. Sotirchos and S. Zarkanitis</b>                          | 1487 | A distributed pore size and length model for porous media reacting with diminishing porosity  |
| <b>C. Tsouris and L. L. Tavlarides</b>                            | 1503 | Mass-transfer effects on droplet phenomena and extraction column hydrodynamics revisited  |
| <b>M. Berezowski and A. Burghardt</b>                             | 1517 | Stability analysis of steady-state solutions for porous catalytic pellets: influence of the Lewis number                                |
| <i>Shorter Communication</i>                                      |      |   |
| <b>P. Dasgupta and S. Bhattacharjee</b>                           | 1535 | Prediction of boiling point of halomethanes by atomic contribution method and their correlation with geometric volume                   |
| <i>Book Reviews</i>   |      |   |
| <b>C. A. Floudas</b>  | 1539 | Chemical Process Structures and Information Flows. Edited by R. S. H. Mah   |
| <b>J. Nielsen</b>   | 1540 | Modeling and Optimization of Fermentation Processes. Edited by B. Volesky and J. Votruba  |
| <b>J. Garside</b>   | 1540 | The Science of Crystallization: Macroscopic Phenomena and Defect Generation. By W. A. Tiller  |
| <b>F. Bakhtar</b>   | 1541 | Engineering Thermodynamics, Work and Heat Transfer. By G. F. C. Rogers and Y. R. Mayhew   |

- A. Johnson** 1541 Applied Digital Control. Theory, Design and Implementation. By J. R. Leigh
- K. Scott** 1542 Electrochemical Oxygen Technology. By K. Kinoshita

## Number 9

- E. S. Kikkinides and R. T. Yang** 1545 Effects of bed pressure drop on isothermal and adiabatic adsorber dynamics
- H. Ozoe, Y. Mo, K. Kanatani and T. Sato** 1557 Transient replacement process of temperature-stratified flow of water in a horizontal duct
- F. González-Patino, J. Catalán and M. A. Galán** 1567 Affinity chromatography: effect of particle size on adsorption equilibrium and mass transfer kinetics
- R. Clift and S. Rafailidis** 1575 Interparticle stress, fluid pressure, and bubble motion in gas-fluidised beds
- A. C. Hoffmann, L. P. B. M. Janssen and J. Prins** 1583 Particle segregation in fluidised binary mixtures
- V. Linek, P. Beneš, J. Sinkule and T. Moucha** 1593 Non-ideal pressure step method for  $k_L a$  measurement
- J. H. D. Hampton, S. B. Savage and R. A. L. Drew** 1601 Computer modelling of filter pressing and clogging in a random tube network
- G. Carta** 1613 Exact solution and linear driving force approximation for cyclic mass transfer in a bidisperse sorbent
- V. V. Ranade and R. A. Mashelkar** 1619 Turbulent mixing in dilute polymer solutions
- F. Stroh and V. Balakotaiah** 1629 Flow maldistributions in packed beds: effect of reactant consumption
- A. G. Livingston and S. F. Zhang** 1641 Hydrodynamic behaviour of three-phase (gas-liquid-solid) airlift reactors
- A. M. J. Davis and C. R. Ethier** 1655 Transport through materials bounded by porous surfaces
- J. Kramarz and A. Wyczesany** 1665 Development and application of continuous thermodynamics for complex chemical equilibria calculations
- B. R. Locke and P. Arce** 1675 Applications of self-adjoint operators to electrophoretic transport, enzyme reactions, and microwave heating problems in composite media—I. General formulation
- K. Rietema, E. J. E. Cottaar and H. W. Piepers** 1687 The effect of interparticle forces on the stability of gas-fluidized beds—II. Theoretical derivation of bed elasticity on the basis of van der Waals forces between powder particles
- Z. P. Lu, J. M. Loureiro, A. E. Rodrigues and M. D. LeVan** 1699 Pressurization and blowdown of adsorption beds—II. Effect of the momentum and equilibrium relations on isothermal operation
- S. Ramaswami, S. Hartland and J. R. Bourne** 1709 A study of disproportionation effects in semi-batch foams—I. Simulation of evolution of bubble size distribution
- S. Hartland, J. R. Bourne and S. Ramaswami** 1723 A study of disproportionation effects in semi-batch foams—II. Comparison between experiment and theory

## Number 10

- |  |      |  |
|--|------|--|
| <b>W. Rommel, E. Blass and W. Meon</b>   | 1735 | Plate separators for dispersed liquid-liquid systems: the role of partial coalescence  |
| <b>N. M. Juhasz and W. M. Deen</b>   | 1745 | Mass transfer in a tube with wall flux confined to evenly spaced discrete areas  |
| <b>E. Fransson, L. Vamling and J. Vidal</b>                                    | 1753 | The Abdoul-Rauzy-Pénéloux group contribution equation of state extended to CFC-containing mixtures   |
| <b>S. M. Kresta and P. E. Wood</b>   | 1761 | The flow field produced by a pitched blade turbine: characterization of the turbulence and estimation of the dissipation rate  |
| <b>W. Chen and J. C. Berg</b>  | 1775 | The effect of polyelectrolyte dosage on floc formation in protein precipitation by polyelectrolytes  |
| <b>P. M. Wilkinson, H. Haringa, F. P. A. Stokman and L. L. van Dierendonck</b> | 1785 | Liquid mixing in a bubble column under pressure  |
| <b>T. Nishimura, S. Murakami and Y. Kawamura</b>                               | 1793 | Mass transfer in a symmetric sinusoidal wavy-walled channel for oscillatory flow   |
| <b>S.-Y. Suen, M. Caracotsios and M. R. Etzel</b>                              | 1801 | Sorption kinetics and axial diffusion in binary-solute affinity-membrane bioseparations  |
| <b>K. S. Sorbie and C. J. Tomlinson</b>  | 1813 | Analytical method for evaluating the effective molecular diffusion coefficient within porous media   |
| <b>M. V. Ramani, R. Kumar and K. S. Gandhi</b>                                 | 1819 | Drainage and separation factors for static foams containing agglomerates of microbial cells  |
| <b>N. Fidi, S. A. K. Jeelani, K. May and S. Hartland</b>                       | 1833 | Use of submerged jets in gas desorption from supersaturated solutions  |
| <b>K.-H. Zhu and B. W. Wojciechowski</b>                                       | 1843 | The behaviour of selectivity on decaying catalysts tested in a fixed-bed reactor   |
| <b>M. D. Shieh and C. Lee</b>  | 1851 | A more general structural model which includes the induction time for gas-solid reactions—II. The kinetics of alpha-boron nitride oxidation                                    |
| <b>I. Devotta and R. A. Mashelkar</b>  | 1859 | Modelling of polyethylene terephthalate reactors—X. A comprehensive model for solid-state polycondensation process   |
| <b>R. Baratti, H. Wu, M. Morbidelli and A. Varma</b>                           | 1869 | Optimal catalyst activity profiles in pellets—X. The role of catalyst loading  |
| <b>F. J. Dickin, R. A. Williams and M. S. Beck</b>                             | 1883 | Determination of composition and motion of multicomponent mixtures in process vessels using electrical impedance tomography—I. Principles and process engineering applications |
| <i>Shorter Communications</i>  |      |  |
| <b>F. Káta</b>   | 1899 | The scheduling of the batch chemical systems   |
| <b>G. Li and H. Rabitz</b>   | 1903 | The direct lumping approach: an application to a catalytic reforming model   |
| <b>J. Landau</b>   | 1909 | Reversal of direction of transfer in desorption with a chemical reaction   |
| <b>M. Goto and T. Hirose</b>   | 1912 | Approximate rate equation for intraparticle diffusion with or without reaction   |

- C. Azzaro, P. Duverneuil and J. P. Couderc** 1915 Comments on the influence of the entrance zone in LPCVD reactors for *in situ* phosphorus-doped polysilicon deposition
- I. C. Kemp** 1923 *Book Reviews*  
Drying of Loose and Particulate Materials. By R. B. Kee
- P. A. Shamlou** 1923 Slurry Handling: Design of Solid-Liquid Systems. Edited by N. P. Brown and N. I. Heywood

## Number 11

- J. J. Thiart, S. M. Bradshaw, H. J. Viljoen and V. Hlavacek** 1925 Thermochemical stress development in ceramic catalyst supports
- M. Giona and A. Adrover** 1933 Influence of local fields on macroscopic transport coefficients
- T. J. van der Walt, J. S. J. van Deventer and E. Barnard** 1945 The dynamic modelling of ill-defined processing operations using connectionist networks
- A. N. R. Bos, E. Hof, W. Kuper and K. R. Westerterp** 1959 The behaviour of a single catalyst pellet for the selective hydrogenation of ethyne in ethene
- E. A. Efthimiadis and S. V. Sotirchos** 1971 Effects of pore structure on the performance of coal gas desulfurization sorbents
- T. Picaro and E. T. White** 1985 A preliminary study of the fluid mechanics of part-flooded beds
- R. V. Shendye, M. K. Dowd and L. K. Doraiswamy** 1995 Influence of surface nonidealities on catalyst effectiveness
- H. Hildwein and K. Stephan** 2005 Equation of state and equations for viscosity and thermal conductivity of non-polar and polar pure fluids based on the significant-liquid-structure theory
- S. Kumar, R. Kumar and K. S. Gandhi** 2025 A new model for coalescence efficiency of drops in stirred dispersions
- R. Font and F. Ruiz** 2039 Simulation of batch and continuous thickeners
- S. H. Marshall, M. W. Chudacek and D. F. Bagster** 2049 A model for bubble formation from an orifice with liquid cross-flow
- J. A. Ochoa-Tapia, J. A. del Rio P. and S. Whitaker** 2061 Bulk and surface diffusion in porous media: an application of the surface-averaging theorem
- Y. Weiss, G. Ben-Dor, Y. Karni and E. Bar-Ziv** 2083 Monte Carlo simulations of heat and mass transfer with chemical reactions of heterogeneous reacting systems
- H. Kreulen, C. A. Smolders, G. F. Versteeg and W. P. M. van Swaaij** 2093 Determination of mass transfer rates in wetted and non-wetted microporous membranes
- D. T. Lynch** 2103 Chaotic behavior of reaction systems: consecutive quadratic/cubic autocatalysis via intermediates
- I. Machač, P. Mikulášek and I. Ulbrichová** 2109 Non-Newtonian fluidization of spherical-particle beds
- D. D. Do and X. Hu** 2119 An energy-distributed model for adsorption kinetics in large heterogeneous microporous particles

- M. A. Taylor and I. G. Kevrekidis** 2129 Couple, double, toil and trouble: a computer assisted study of two coupled CSTRs
- J. B. Illerup, K. Dam-Johansen and K. Lundén** 2151 High-temperature reaction between sulfur dioxide and limestone—VI. The influence of high pressure
- C. C. Pu and C. I. Lin** 2159 Variations of physical properties in pellets containing magnesium during calcination and sulfation
- Shorter Communications*
- H.-S. Liu, S.-S. Wang and H.-W. Hsu** 2169 Double-substrate interactive model
- M. Punčochář and J. Drahoš** 2173 The tortuosity concept in fixed and fluidized bed
- 2177 Erratum

## Number 12

- T. A. Ebert, L. R. Glicksman and M. Lints** 2179 Determination of particle and gas convective heat transfer components in a circulating fluidized bed
- C. W. Turner** 2189 Rates of particle deposition from aqueous suspensions in turbulent flow: a comparison of theory with experiment
- H. Vinke, P. J. Hamersma and J. M. H. Fortuin** 2197 Enhancement of the gas-absorption rate in agitated slurry reactors by gas-adsorbing particles adhering to gas bubbles
- T. A. G. Langrish, R. B. Keey, P. C. S. Kho and J. C. F. Walker** 2211 Time-dependent flow in arrays of timber boards: flow visualization, mass-transfer measurements and numerical simulation
- J. Rudin and D. T. Wasan** 2225 Interfacial turbulence and spontaneous emulsification in alkali-acidic oil systems
- T. A. Carroll and W. F. Ramirez** 2239 Development of positive optical photoresists: adaptive control
- K. S. Lim, V. S. Gururajan and P. K. Agarwal** 2251 Mixing of homogeneous solids in bubbling fluidized beds: theoretical modelling and experimental investigation using digital image analysis
- H. Yoshida, A. Okamoto and T. Kataoka** 2267 Adsorption of acid dye on cross-linked chitosan fibers: equilibria
- A. G. Gayubo, J. M. Arandes, A. T. Aguayo, M. Olazar and J. Bilbao** 2273 Selective kinetic deactivation model for a triangular reaction scheme
- N. P. Hand and P. L. Spedding** 2283 Horizontal gas-liquid flow at close to atmospheric conditions
- E. K. T. Kam** 2307 Prediction of thermal conductivity of binary azeotropic liquid mixtures
- G. Philippou and D. Luss** 2313 Temperature patterns on a catalytic ribbon heated by a constant voltage
- G. Philippou, M. Somani and D. Luss** 2325 Traveling temperature fronts on catalytic ribbons
- H. Benkreira and R. Patel** 2329 Direct gravure roll coating

## Number 13

- J. Bridgwater** iii New Editorial Board procedures
- Z.-X. Zhu and A. Jutan** 2337 Stability robustness for decentralized control systems
- B. Zou, M. P. Duduković and P. L. Mills** 2345 Modeling of evacuated pulse micro-reactors
- J. H. Chang and W. K. Lee** 2357 Modeling of enzymatic reaction with emulsion liquid membrane
- C. M. van den Bleek and J. C. Schouten** 2367 Can deterministic chaos create order in fluidized-bed scale-up?
- J. M. Hansen, H. C. Lim and J. Hong** 2375 Optimization of autocatalytic reactions
- G. H. Meeten** 2391 A dissection method for analysing filter cakes
- R. V. Bravo, R. F. Camacho, V. M. Moya and R. M. Aguado** 2399 Absorption of SO<sub>2</sub> into tribasic sodium citrate solutions
- S. Kumar, K. Kusakabe and L.-S. Fan** 2407 Heat transfer in three-phase fluidized beds containing low-density particles
- J. J. Suárez, J. L. Bueno and I. Medina** 2419 Determination of binary diffusion coefficients of benzene and derivatives in supercritical carbon dioxide
- E. D. Snijder, G. F. Versteeg and W. P. M. van Swaaij** 2429 Hydrogenation of cyclohexene with LaNi<sub>5-x</sub>Al<sub>x</sub>H<sub>n</sub> metal hydrides suspended in cyclohexane or ethanol
- S. Ledakowicz and J. S. Miller** 2443 Kinetics of tetrachloroethene photochlorination
- S. Vajda and H. Rabitz** 2453 Generalized parametric sensitivity: application to a CSTR
- M. Grzesik and J. Skrzypek** 2463 Enhancement of heterogeneous autocatalytic reactions by intraparticle diffusion
- M. Grzesik and J. Skrzypek** 2469 Enhancement of heterogeneous autocatalytic reactions by external diffusion
- J. D. Lu, G. Flamant and P. Snabre** 2479 Towards a generalized model for vertical walls to gas-solid fluidized beds heat transfer—I. Particle convection and gas convection
- G. Flamant, J. D. Lu and B. Variot** 2493 Towards a generalized model for vertical walls to gas-solid fluidized beds heat transfer—II. Radiative transfer and temperature effects

## Number 14

- G. Astarita** 2505 Chemical engineering science
- R. Aris** 2507 **Review Article Number 37. Ends and beginnings in the mathematical modelling of chemical engineering systems**
- P. N. Rowe** 2519 **Review Article Number 38. A model for chemical reaction in the entry region of a gas fluidised-bed reactor**
- J. Villiermaux** 2525 **Review Article Number 39. Future challenges for basic research in chemical engineering**

- M. Quintard and S. Whitaker** 2537 **Review Article Number 40. Transport in ordered and disordered porous media: volume-averaged equations, closure problems, and comparison with experiment**
- C. M. H. Brereton and J. R. Grace** 2565 Microstructural aspects of the behaviour of circulating fluidized beds
- R. Baratti, J. Alvarez and M. Morbidelli** 2573 Design and experimental verification of a nonlinear catalytic reactor estimator
- M. Barigou and J. F. Davidson** 2587 The fluid mechanics of the soap film meter
- C. Roizard, F. Mokrani, H. le Gall and N. Midoux** 2599 Gas absorption in a centrifugal reactor: hydrodynamics
- V. G. Dovi' and A. P. Reverberi** 2609 Optimal solutions of processes described by systems of differential-algebraic equations
- M. R. Sarmidi and P. E. Barker** 2615 Simultaneous biochemical reaction and separation in a rotating annular chromatograph
- D. D. Do and H. Do** 2625 Effect of micropore size distribution on the surface diffusivity in microporous solids
- S. C. Reyes, E. Iglesia and C. P. Kelkar** 2643 Kinetic-transport models of bimodal reaction sequences—I. Homogeneous and heterogeneous pathways in oxidative coupling of methane
- D. Lj. Petrović, D. Pošarac, A. Duduković and D. Skala** 2663 *Shorter Communication*  
Minimum fluidization velocity of large particles in a draft tube airlift reactor
- K. R. Westerterp, W. de Jong and G. H. W. van Benthem** 2669 *Letters to the Editors*  
Comments on discrimination of three approaches to evaluate heat fluxes for wall-cooled fixed bed chemical reactors
- D. Vortmeyer and E. Haidegger** 2670 Authors' reply to comments by K. R. Westerterp *et al.*

## Number 15

- B. Tabiś and A. Essekkat** 2675 Steady states of circulating systems with fluidized-bed reactors
- J. Abbasian, J. R. Wangerow and A. H. Hill** 2689 Effect of HCl on sulfidation of calcium oxide
- Z.-S. Mao, T.-Y. Xiong and J. Chen** 2697 Theoretical prediction of static liquid holdup in trickle bed reactors and comparison with experimental results
- M. P. Harold, V. T. Zaspalis, K. Keizer and A. J. Burggraaf** 2705 Intermediate product yield enhancement with a catalytic inorganic membrane—I. Analytical model for the case of isothermal and differential operation
- J. A. Hogendoorn, G. F. Versteeg and W. P. M. van Swaaij** 2727 Mass transfer accompanied by reversible chemical reactions in an inert porous sphere impregnated with a stagnant liquid
- A. G. Gayubo, J. M. Arandes, A. T. Aguayo, M. Olazar and J. Bilbao** 2741 Reaction-regeneration cycles in the isomerization of *cis*-butene and calculation of the reactivation kinetics of a silica-alumina catalyst
- V. Gekas, P. Aimar, J.-P. Lafaille and V. Sanchez** 2753 A simulation study of the adsorption-concentration polarisation interplay in protein ultrafiltration



- J. D. Sherwood** 2767 Formation of a cement filtercake above a compactible mudcake
- A. Micke and M. Bülow** 2777 Modelling the complex problem of intracrystalline diffusion and first-order phenomena in microporous solid particles under constant-volume/variable-concentration conditions
- A. Seidel-Morgenstern and G. Guiochon** 2787 Modelling of the competitive isotherms and the chromatographic separation of two enantiomers
- M. Berezowski** 2799 Dynamic profiles in chemical reactors with recycle
- B. J. Azzopardi** 2807 Liquid distribution in venturi scrubbers: the importance of liquid films on the channel walls
- Shorter Communications*
- Y. D. Chen, R. T. Yang and L. M. Sun** 2815 Further work on predicting multicomponent diffusivities from pure-component diffusivities for surface diffusion and diffusion in zeolites
- S. S. Tambe and B. D. Kulkarni** 2817 Intermittency route to chaos in a periodically forced model reaction system
- J. Guan and Z. Ye** 2821 Analog circuit for simulation of pressure swing adsorption: kinetic model
- Book Reviews*
- K. J. Hunt** 2825 Applied Optimal Control and Estimation: Digital Design and Implementation. By F. L. Lewis
- J. Bridgwater** 2825 Perspectives in Chemical Engineering, Research and Education. Edited by C. K. Colton
- 2827 Announcement

## Number 16

- A. Johnson** 2829 **Review Article Number 41. LQG applications in the process industries**
- J. Sallès, J. F. Thovert and P. M. Adler** 2839 Deposition in porous media and clogging
- T. C. Keener and S.-J. Khang** 2859 Kinetics of the sodium bicarbonate-sulfur dioxide reaction
- N. Brauner and D. Moalem Maron** 2867 The role of interfacial shear modelling in predicting the stability of stratified two-phase flow
- B. W. Wojciechowski and N. M. Rice** 2881 Temperature-scanning plug flow reactor
- A. C. Michalopoulou, V. N. Burganos and A. C. Payatakes** 2889 Hydrodynamic interactions of two permeable particles moving slowly along their centerline
- R. S. Figliola and D. E. Beasley** 2901 A study of the particle convection contribution to heat transfer in gas fluidized beds
- N. E. Sherman and J. D. Sherwood** 2913 Cross-flow filtration: cakes with variable resistance and capture efficiency
- F. W. Petersen, J. S. J. van Deventer and L. Lorenzen** 2919 The interaction between metal cyanides, fine particles and porous adsorbents in an agitated slurry

- |  |      |  |
|--|------|--|
| <b>R. M. Quinta Ferreira and<br/>A. E. Rodrigues</b>     | 2927 | Diffusion and catalytic zero-order reaction in a macroreticular ion exchange resin   |
| <b>J. G. M. Winkelman and<br/>A. A. C. M. Beenackers</b> | 2951 | Simultaneous absorption and desorption with reversible first-order chemical reaction: analytical solution and negative enhancement factors |
| <b>N. J. M. Kuipers and<br/>A. A. C. M. Beenackers</b>   | 2957 | Non-Fickian diffusion with chemical reaction in glassy polymers with swelling induced by the penetrant: a mathematical model               |
| <b>X. Li</b>   | 2973 | Spatial instability of plane liquid sheets   |

## Number 17

- |   |      |  |
|---|------|--|
| <b>P. Henriksen and O. Hassager</b>                             | 2983 | Simulation of transport phenomena in ultrafiltration   |
| <b>D. M. Scott</b>  | 3001 | Effects of bed pressure drop on adsorption and desorption with Langmuir isotherms                                      |
| <b>S. J. Parulekar and J. Lee</b>                               | 3007 | Structure analysis of continuous cultures subject to periodic medium tuning  |
| <b>H. Fujita</b>  | 3037 | Comments on free volume theories for polymer-solvent systems   |
| <b>J. L. Moseley and T. J. O'Brien</b>                          | 3043 | A model for agglomeration in a fluidized bed   |
| <b>Z. A. Metaxiotou and S. G. Nychas</b>                        | 3051 | A visual study of liquid motion in vertical capillaries under conditions of inverse density gradients                  |
| <b>I. N. Alves, O. Shoham and Y. Taitel</b>                     | 3063 | Drift velocity of elongated bubbles in inclined pipes  |
| <b>A. S. Wood</b>   | 3071 | The butt-fusion welding of polymers  |
| <i>Shorter Communications</i>                                   |      |  |
| <b>Ph. Nore and A. Mersmann</b>                                 | 3083 | Batch precipitation of barium carbonate  |
| <b>J. J. Benbow and J. Bridgwater</b>                           | 3088 | The cutting of paste extrudates  |
| <b>S. Kumar, R. Kumar and<br/>K. S. Gandhi</b>                  | 3092 | A simplified procedure for predicting $d_{max}$ in stirred vessels   |
| <b>P. Brandani, V. Brandani,<br/>G. Del Re and L. Masciulli</b> | 3096 | Comparison between a noncubic equation of state particularly suitable for polar fluids and the Soave equation of state |
| <b>T. Ishida, Y. Iwai, Y. Arai and<br/>A. Sakoguchi</b>         | 3100 | Estimation of solid molar volumes using the neighboring factor with application to isomeric compounds                  |
| <b>J. Dudáš, O. Seitz and<br/>L. Jelemenský</b>                 | 3104 | Chemical reaction in spouted beds  |

## Number 18

iii Danckwerts-Pergamon Prize

- |   |      |  |
|---|------|--|
| <b>A. A. C. M. Beenackers and<br/>W. P. M. van Swaaij</b> | 3109 | <b>Review Article Number 42. Mass transfer in gas-liquid slurry reactors</b> |
| <b>P. Rouchon and Y. Creff</b>                            | 3141 | Geometry of the flash dynamics   |

- H. Nicolaisen, P. Rasmussen and J. M. Sørensen** 3149 Correlation and prediction of mineral solubilities in the reciprocal salt system  $(\text{Na}^+, \text{K}^+)(\text{Cl}^-, \text{SO}_4^{2-})\text{-H}_2\text{O}$  at 0–100°C
- J.-Y. Lin and C.-C. Yu** 3159 Automatic tuning and gain scheduling for pH control
- E. Alpay, C. N. Kenney and D. M. Scott** 3173 Simulation of rapid pressure swing adsorption and reaction processes
- R. A. Davis and O. C. Sandall** 3187 Kinetics of the reaction of carbon dioxide with secondary amines in polyethylene glycol
- G. S. Patience and J. Chaouki** 3195 Gas phase hydrodynamics in the riser of a circulating fluidized bed
- R. A. Wright and C. Kravaris** 3207 Dynamically equivalent outputs and their use in nonlinear controller synthesis
- O. Masbernat, C. Gourdon and G. Casamatta** 3225 Local measurements in a dense two-phase liquid flow: continuous-phase point velocity and phase ratio
- H. D. Do and W. V. Pinczewski** 3243 Diffusion-controlled swelling of reservoir oil by indirect contact with injection gas
- V. S. Saraph and M. M. Sharma** 3253 Kinetics of liquid phase air oxidation of 2,6-di-tert-butylphenol
- P. G. Smirniotis and E. Ruckenstein** 3263 The performance of Pt/ $\beta$  zeolite and Pt/ $\gamma$ - $\text{Al}_2\text{O}_3$  composite pellets in the reforming of methylcyclopentane and methylcyclohexane
- M. Grzesik, J. Skrzypek and B. W. Wojciechowski** 3273 Time-on-stream catalyst decay behaviour in fluidized-bed catalytic reactors under the influence of intraparticle diffusion
- I. Ziółkowska and D. Ziółkowski** 3283 Modelling of gas interstitial velocity radial distribution over a cross-section of a tube packed with a granular catalyst bed
- M. R. Mackley and X. Ni** 3293 Experimental fluid dispersion measurements in periodic baffled tube arrays
- D. M. Ruthven and Z. Xu** 3307 Diffusion of oxygen and nitrogen in 5A zeolite crystals and commercial 5A pellets
- M. Del Pozo, C. L. Briens and G. Wild** 3313 Particle-particle collisions in liquid-solid and gas-liquid-solid fluidized beds
- A. S. Teja** 3321 *Book Reviews*  
Modelling Phase Equilibria: Thermodynamic Background and Practical Tools. Edited by S. Malanowski and A. Anderko
- H. Hofmann** 3322 DECHEMA Chemistry Data Series, Vol. 12/1. By J. Barthel and R. Neneder

## Number 19

- M. M. Tomadakis and S. V. Sotirchos** 3323 Ordinary, transition, and Knudsen regime diffusion in random capillary structures
- K. M. Vanden Bussche, S. N. Neophytides, I. A. Zolotarskii and G. F. Froment** 3335 Modelling and simulation of the reversed flow operation of a fixed-bed reactor for methanol synthesis

- C. W. Stewart, C. T. Crowe and S. C. Saunders** 3347 A model for simultaneous coalescence of bubble clusters
- J. D. Sherwood** 3355 A model for static filtration of emulsions and foams
- Y.-J. Lee, D. L. Feke and I. Manas-Zloczower** 3363 Dispersion of titanium dioxide agglomerates in viscous media
- G. Defaye, N. Regnier, J. Chabanon, L. Caralp and C. Vidal** 3373 Adaptive-predictive temperature control of semi-batch reactors
- J. Baldyga, J. R. Bourne and Yang Yang** 3383 Influence of feed pipe diameter on mesomixing in stirred tank reactors
- L. K. Filippov** 3391 Study of adsorption on polymer by ellipsometry
- R. C. Everson, D. Eyre, C. T. O'Connor and J. P. Tucker** 3399 Measurement and analysis of small bubble size distributions
- V. Gupta and S. K. Bhatia** 3405 Growth rate dispersion in MSMPR crystallizers: solution by regularization
- K. Terasaka and H. Tsuge** 3417 Bubble formation under constant-flow conditions
- P. Pranda and A. Brunovská** 3423 Optimal catalyst pellet activity distributions for deactivating systems: experimental study
- Shorter Communications*
- D. E. Smiles and J. M. Kirby** 3431 Compressive cake filtration—a comment
- E. Tsotsas** 3434 Low Péclet number transient heat transfer in packed beds: re-evaluation of the data of Donnadieu
- G. Astarita** 3438 Forces acting on particles in a fluidized bed
- A. B. Pandit and J. B. Joshi** 3440 Hydrolysis of fatty oils: effect of cavitation
- M. R. Gray, B. Mehta and J. H. Masliyah** 3442 Liquid-side mass transfer coefficients for liquids and slurries in a rotating drum

## Number 20

- M. H. Kaspar and W. H. Ray** 3447 Dynamic PLS modelling for process control
- A. Cybulski, R. Edvinsson, S. Irandoust and B. Andersson** 3463 Liquid-phase methanol synthesis: modelling of a monolithic reactor
- J. Ahlbeck, T. Engman, S. Fältén and M. Vihma** 3479 A method for measuring the reactivity of absorbents for wet flue gas desulfurization
- P. Synowiec, A. G. Jones and P. Ayazi Shamlou** 3485 Crystal break-up in dilute turbulently agitated suspensions
- M. T. Sena Esteves and J. R. F. Guedes de Carvalho** 3497 Liquid-side mass transfer coefficient for gas slugs rising in liquids
- A. Negiz, M. A. Hastaoglu and R. A. Heidemann** 3507 Three-dimensional transient heat transfer from a buried pipe—I. Laminar flow
- E.-A. Brujan** 3519 The effect of polymer additives on the bubble behavior and impulse pressure

- A. Wolny and W. Kaźmierczak 3529 The influence of static electrification on dynamics and rheology of fluidized bed
- R. C. Brown 3535 Theory of airflow through filters modelled as arrays of parallel fibres
- J. K. Bandyopadhyay,  
V. Ravi Kumar, B. D. Kulkarni  
and P. Bhattacharya 3545 Stabilizing the operation of a nonisothermal CSTR: a model study using a single-variable nonlinear controller
- H. J. Keh and F. R. Yang 3555 Boundary effects on osmophoresis: motion of a vesicle in an arbitrary direction with respect to a plane wall
- H. J. Keh and L. S. Chen 3565 Droplet interactions in thermocapillary migration
- 3583 Corrigenda

## Number 21

- A. K. Biń 3585 **Review Article Number 43. Gas entrainment by plunging liquid jets**
- S. S. Lele, J. B. Joshi and  
S. J. Parulekar 3631 Underutilization of loop reactors due to desorption
- L. Prigozhin 3647 A variational problem of bulk solids mechanics and free-surface segregation
- J. A. Levesley and B. J. Bellhouse 3657 Particulate separation using inertial lift forces
- T. M. Linjewile, A. S. Hull  
and P. K. Agarwal 3671 Heat transfer to a large mobile particle in gas-fluidized beds of smaller particles
- V. R. Khandavalli, V. Dharma Rao,  
M. V. Ramakanth  
and K. V. Athota 3677 Evaluation of stability of a catalytic fixed-bed reactor from a steady-state model
- W. H. Chen, H. C. Hu and T. Y. Lee 3683 Transient crystallization and crystal size distribution of zeolite A
- J. A. S. Cleaver and  
R. M. Nedderman 3693 Theoretical prediction of stress and velocity profiles in conical hoppers
- J. A. S. Cleaver and  
R. M. Nedderman 3703 Measurement of velocity profiles in conical hoppers
- A. Gadomski, Z. J. Grzywina  
and J. Łuczka 3713 The growing processes in diffusive and convective fields
- R. Gutsche 3723 Concentration-dependent micropore diffusion analysed by measuring laboratory adsorber dynamics—I. Study of the adsorber flow behaviour
- R. Gutsche 3735 Concentration-dependent micropore diffusion analysed by measuring laboratory adsorber dynamics—II. Study of the micropore diffusion mechanism

## Number 22

- J. J. Zacca and W. H. Ray 3743 Modelling of the liquid phase polymerization of olefins in loop reactors

- C. Kuechen and U. Hoffmann** 3767 Investigation of simultaneous reaction of carbon monoxide and carbon dioxide with hydrogen on a commercial copper/zinc oxide catalyst
- F. Y. Wang and I. T. Cameron** 3777 Graph theoretical methods in control systems analysis
- L. M. Sun and V. Bourdin** 3783 Measurement of intracrystalline diffusion by the frequency response method: analysis and interpretation of bimodal response curves
- K. Li and R. Hughes** 3795 Internal staging for membrane gas separation: comparison with conventional membrane permeators
- A. M. Duquenne, P. Guiraud and J. Bertrand** 3805 Swirl-induced improvement of turbulent mixing: laser study in a jet-stirred tubular reactor
- L. P. Lindfors, T. Salmi and S. Smeds** 3813 Kinetics of toluene hydrogenation on Ni/Al<sub>2</sub>O<sub>3</sub> catalyst
- M. R. Baker** 3829 Droplet breakup using in-line mixers located in recirculation loops around batch vessels
- N. Yan** 3835 A mass transfer model for type-II-facilitated transport in liquid membranes
- D. J. Gunn and H. B. S. Al-Saffar** 3845 Liquid distribution in packed columns
- Shorter Communications*
- G. Maria and D. W. T. Rippin** 3855 Note concerning two techniques for complex kinetic pathway analysis
- V. Tassone and R. Luus** 3864 Reduction of allowable values for control in iterative dynamic programming
- J. Texter, I. A. Watson, D. S. Ross, K. C. Ng and R. C. Dempsey** 3868 Domain of convergence for convective flow to rotating disks
- K. Yin** 3870 Parameter estimation and related problems for external input-output models
- Book Reviews*
- J. M. McNaught** 3877 Heat Exchangers. Edited by H. Martin
- S. Blackburn** 3877 Modern Ceramic Engineering, Process, Processing and Use in Design. By D. W. Richerson
- D. E. Rivera** 3878 Integrated Process Control and Automation. By J. E. Rijnsdorp

## Number 23

- B. A. Buffham and G. Mason** 3879 Holdup and dispersion: tracer residence times, moments and inventory measurements
- M. Fermeiglia and I. Kikic** 3889 The perturbed hard chain theory for the prediction of supercritical fluid extraction: binary mixtures
- Z. I. Mandralis and D. L. Feke** 3897 Continuous suspension fractionation using acoustic and divided-flow fields
- D. M. Wang and J. M. Tarbell** 3907 Closure models for turbulent reacting flows with a non-homogeneous concentration field

- |  |      |   |
|--|------|---|
| <b>J. Thullie and A. Renken</b>                          | 3921 | Model discrimination for reactions with a stop-effect   |
| <b>G. Carta and A. E. Rodrigues</b>                      | 3927 | Diffusion and convection in chromatographic processes using permeable supports with a bidisperse pore structure   |
| <b>A. Wolffberg and M. Sheintuch</b>                     | 3937 | Density distribution of growing immobilized cells   |
| <b>D. F. Marr, A. M. Gola-Galimidi and W. E. Stewart</b> | 3945 | Transport modelling of packed-tube reactors—III. Initial data-based functions and application   |
| <b>A. A. Adetayo, J. D. Litster and M. Desai</b>         | 3951 | The effect of process parameters on drum granulation of fertilizers with broad size distributions   |
| <b>S. G. Hatzikiriakos and P. Englezos</b>               | 3963 | The relationship between global warming and methane gas hydrates in the earth   |
| <b>L. T. Fan, B. C. Shen and S. T. Chou</b>              | 3971 | The surface-renewal theory of interphase transport: a stochastic treatment  |
| <b>J. J. Meerman and H. J. H. Brouwers</b>               | 3983 | Clean pressure drop of non-Newtonian liquid flow across stacked-disc filters  |
| <b>R. H. Davis and H. A. Stone</b>                       | 3993 | Flow through beds of porous particles   |
| <b>B. R. Locke, P. Arce and Y. Park</b>                  | 4007 | Applications of self-adjoint operators to electrophoretic transport, enzyme reactions, and microwave heating problems in composite media—II. Electrophoretic transport in layered membranes |
| <b>Z. Kemplowski, J. Przywarski and A. Diab</b>          | 4023 | An average gas hold-up and liquid circulation velocity in airlift reactors with external loop   |
| <b>S. Stenström</b>                                      | 4037 | The modelling of drop behaviour in siphon riser tubes in paper drying cylinders   |
|  | 4049 | Corrigenda  |
| Number 24  |      |   |
| <b>J. D. Snyder and B. Subramaniam</b>                   | 4051 | Numerical simulation of a periodic flow reversal reactor for sulphur dioxide oxidation  |
| <b>S. J. Baek and H. H. Lee</b>                          | 4065 | Transport effects in a class of nonisothermal multiphase catalytic reactions  |
| <b>J. Y. Lai, J. M. Jen and S. H. Lin</b>                | 4069 | Gas permeation in polycarbonate membranes prepared by the wet-phase inversion method  |
| <b>G. V. Bhaskar, O. H. Campanella and P. A. Munro</b>   | 4075 | Effect of agitation on the coagulation time of mineral acid casein curd: application of Smoluchowski's orthokinetic aggregation theory  |
| <b>S. M. Stark, M. Neurock and M. T. Klein</b>           | 4081 | Strategies for modelling kinetic interactions in complex mixtures: Monte Carlo algorithms for MIMD parallel architectures   |
| <b>C. Tsouris and L. L. Tavlarides</b>                   | 4097 | Control of holdup and solute concentration in an Oldshue-Rushton extraction column  |
| <b>G. M. Zhong and F. Meunier</b>                        | 4105 | Interference theory—I. Moment solution for two-component nonequilibrium adsorption chromatography   |
| <b>G. M. Zhong and F. Meunier</b>                        | 4109 | Interference theory—II. Moment solution for three-component nonequilibrium adsorption chromatography  |

- G. M. Zhong, L. M. Sun  
and F. Meunier** 4115 Interference theory—III. Moment solution for linear  
isothermal multicomponent adsorption in a pellet
- K. A. Kusters, S. E. Pratsinis,  
S. G. Thoma and D. M. Smith** 4119 Ultrasonic fragmentation of agglomerate powders
- S. Farooq, M. N. Rathor  
and K. Hidajat** 4129 A predictive model for a kinetically controlled pressure  
swing adsorption separation process
- M. Korc and M. Feinberg** 4143 Multiple steady states as a source of pattern formation in  
complex multicell chemical systems
- Book Review*
- S. Hartland** 4453 Transport Process in Bubbles, Drops and Particles. Edited  
by R. P. Chhabra and D. De Kee
- i Index to Vol. 48, 1993



